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but is a vile pest moving northward and eastward, and if not checked in its course will bring dismay to thousands of farmers who now know nothing of its pernicious habits.

The interested reader can quickly select from the table the species which are most prevalent over the whole United States, but the relative injuriousness, which is obtained by dividing the denominator by the numerator, is not so easily seen. The following list of 20 is therefore given in the order of injuriousness, beginning with the worst:

<i>Cnicus arvensis.</i>	<i>Setaria glauca.</i>
<i>Agropyrum repens.</i>	<i>Chenopodium album.</i>
<i>Xanthium Canadense.</i>	<i>Chrysanthemum Leucanthemum.</i>
<i>Cenchrus tribuloides.</i>	<i>Portulaca oleracea.</i>
<i>Panicum sanguinale.</i>	<i>Rumex crispus.</i>
<i>Ambrosia artemisiifolia.</i>	<i>Panicum Crus-galli.</i>
<i>Xanthium stramonium.</i>	<i>Convolvulus sepium.</i>
<i>Rumex Acetosella.</i>	<i>Capsella Bursa-pastoris.</i>
<i>Amarantus retroflexus.</i>	<i>Cnicus lanceolatus.</i>
<i>Ambrosia trifida.</i>	<i>Arctium Lappa.</i>

The writer is anxious to add to the number of his reports, and will be pleased to hear not only from every state and territory in the Union, but in such numbers that the summary derived from them may furnish a basis for future calculations, if not for national legislation. Questions of eradication, quarantine and the like, come naturally after the nature of the pests has been settled upon in the broadest sense. The greater part of this work must be done by local observers who are willing to aid in arming ourselves as a nation against a vast array of active enemies to American agriculture. If any one will add to or take from the list of 34 species herein given, let him do so as a bit of public service.

New Brunswick, N. J.

Sweet Cassava (*Jatropha Manihot.*)

H. W. WILEY.

About the middle of March, last year, I received from Mr. R. H. Burr, of Bartow, Fla., a package of cassava roots. These roots reached the department in fine condition, being apparently as fresh as the day they were taken

from the soil. After careful sampling and cleaning a sufficient quantity of the roots was cut into thin slices and thoroughly dried. In a definite weighed portion, sampled as carefully as possible, the percentage of moisture was determined. The dried and powdered roots were preserved for future analysis. Owing to a press of other matter this analysis was not made until the latter part of July and the first of August, 1888. Mr. Burr, in forwarding the roots, sent the following information concerning them :

"The roots do not last long after digging, drying up or rotting. Since this variety of cassava is not the bitter or poisonous kind, it is generally known in Florida as the sweet cassava. The roots are fed to all kinds of stock in a fresh state and are greatly relished. It has been sufficiently tested here to show its great value as stock food. The yield, under favorable conditions, is astonishing. I have recently dug one plant of one year's growth which weighed fifty pounds, being at the rate of more than 1,500 bushels to the acre. Eight hundred to one thousand bushels per acre can be confidently reckoned on."

The roots received by us were long and slender and of various sizes ; some of them were quite two feet long and weighed several pounds. The bark, which contains a poisonous principle if any be present, was carefully scraped off and has been preserved for subsequent examination. The analysis of the sample calculated to dry substance, is given in the following table :

Serial No.....	5547	
Ash.....	1.94	per cent.
Oil (petroleum ether extract).....	1.27	"
Ether extract (glucosides, alkaloids, organic acids, etc.)74	"
Alcohol extract (amids, sugars, resins, etc.).....	17.43	"
Crude fibre.....	4.03	"
Starch.....	71.85	"
Albuminoids (calculated from nitrogen).....	3.47	"
	<hr/> 100.73	

In regard to the method of analysis little need be said ; it was carried on in accordance with the well-established rules of plant analysis as laid down by Dragendorff. The first extraction of petroleum ether gave the fat or oil alone, and the subsequent extraction with sulphuric ether gave the glucosides, alkaloids and organic acids. That portion of nitrogen existing as amids has been estimated in the alcoholic extract. The total nitrogen was also estimated and entered as albuminoids ; a small portion of the nitrogen has thus been counted twice in the total results which add up a little over 100. A characteristic feature of the cassava root is shown in the large amount of substance present soluble in

alcohol. The amount of starch also compares fairly well with the best varieties of potatoes. On account of the large quantity of sugars present the cassava root could be more economically used for the manufacture of glucose than for starch; there is no doubt, however, of the fact that a fine article of starch food can be made from the cassava root growing in this country.

In addition to the fresh root above noted, two samples of the dried root or cassava meal have also been examined. No. 5,922 was sent to us described as pulverized manihot root or cassava flour. The root is first peeled, chopped into thin slices, dried in the sun two days and pulverized. It was prepared by Prof. W. H. Kern, of Bartow, Fla. No. 5,923 was labeled pulverized cassava with the starch, or a portion of it, and the glucose washed out, the remaining pulp dried in the sun, prepared by W. H. Kern, Bonnie Lake, near Bartow, Fla.

Prof. Kern sent a letter with the samples, from which the following extracts are made:

"Allow me to say that owing to the prodigious yield per acre of what we here know as cassava and its alleged value as a feed and food plant and for its yield of starch and glucose, it is attracting a very great deal of attention here now. The plant here grown is different from the manioc root of South and Central America; our root contains no poisonous elements which need to be dissipated by heat. It is customary here for many persons to make their own starch from it. The root, which must remain in the ground until one is ready to use it, is dug, washed and its two inner and outer peelings removed; it is then grated and the pulp washed, the water poured off in a vessel and allowed to stand, when the pure starch settles in the bottom. The clear water is again drawn off and the starch allowed to dry. The pulp, after having the starch washed out, may be used at once in making puddings by the addition of milk, eggs, etc. This washed pulp may be sun dried and thus kept, forming valuable meal or flour from which nice bread may be made. Necessitated, as we are in South Florida, to buy all our wheat flour, anything which acts as a substitute, either in whole or a part, is of great value to us."

The analysis of two samples of flour are given in the following table:

Serial No.....	5922	5923
	Per Cent.	Per Cent.
Water.....	10.56	11.86
Ash.....	1.86	1.13
Oil and fat.....	1.50	.86
Glucosides, alkaloids and organic acids.....	.64	.43
Amids, sugars, resins.....	13.69	4.50
Dextrine, gum, etc., by difference.....	2.85	5.63
Crude fibre.....	2.96	4.15
Nitrogenous bodies.....	1.31	1.31
Starch.....	64.63	70.13

From the above analyses it is seen that the cassava can never take the place of the flour made from cereals as a food material on account of the small portion of nitrogenous matter which it contains. It seems to me, however, that it might very well take the place of potatoes, and its value as a food should not be underestimated.

Mr. S. W. Carson, of Midland, Fla., has made some very valuable contributions to the literature of the native cassava. From a letter of his to the *Florida Farmer and Fruit Grower* of April 11, 1888, I make the following quotations:

"As before stated, I regard the rolling pine lands, containing some willow oak, to be the best for cassava, and the southern counties to be the best suited to it. Let the soil be well prepared by plowing and harrowing, rows checked about four feet apart, one piece laid in each hill. I think they should never be closer together than four feet, and five would be better. Cassava has been known to grow for three years in this country. It will continue to grow until the cold kills it, then by breaking off the stems when they are red, the stubble will sprout up in the spring. As to the seeds of the cassava they will ripen in about one year. If puddings, custards, etc., are desired, the roots must be peeled and grated; salt, sugar, etc., may be used according to taste. The Spaniards make bread of it simply by grating the root and adding salt and a little soda. Now, there is no doubt in my mind but thirty tons of cassava root per acre can be produced. When I think of the tapioca, glucose and starch there are in it, and how abundantly it can be turned into bacon and lard, milk and butter, mutton and beef, I feel confident that it will pay better than any other plant in the world."

Mr. J. H. Moore, of Keuka, Fla., in a letter to the same paper of November 24, 1887, describes some of the uses of cassava. From his letter I make the following extract:

"Cut the stalks about one inch above the ground, just before frost; after cutting, the stalks should be left to dry in a cool place a few weeks, and then placed in a trench and covered until time for planting. Some save the stalks by keeping them in a dry, cool place until February and then plant. The roots should be dug as used; they will not keep in good condition out of the ground more than three or four days. It is, perhaps, the best feed we can raise for hogs; it is also a fine feed for poultry. We often bake it like sweet potatoes, and also slice and fry it like Irish potatoes."

M. Sacc has addressed a letter to the National Society of Agriculture of France concerning cassava, which he calls "*Manihot utilissima*." He is of the opinion that the poisonous varieties are different botanically from the innocent. *Manihot* is the bread of tropical regions. The innocent variety is cultivated in Bolivia, and the botanists there call it "*Manihot Aipi*." The plant grows from one to two metres in height, with straight and naked stalks, since they only develop leaves at their extremities. The only care given

to them in their cultivation is to keep them free from weeds. The roots, to the number of 5 to 9, are of the size of the closed hand. The following analysis of the roots of the Manihot Aïpi is given :

Water.....	70.29	per cent.
Starch	14.40	"
Sugar, salts and malic acid.....	1.01	"
Fibrin and yellow coloring matter08	"
Crude fibre.....	3.16	"
Ash	10.82	"

From the above it is seen that the roots of the tropical plant are quite different from those produced in our own country. In regard to the distribution of the two varieties, M. Sacc makes the following observation :

"In Cuba I have seen only the poisonous variety. The same is true of Brazil, where I have not seen the Manihot Aïpi except in the Swiss colony, Porto Real. As to the product of the two varieties it is the same; the stalks, which are the size of the finger, are from one to two metres in height. I have not been able to analyze the leaves of this interesting vegetable, but, as they are much sought after by cattle, they are probably very nutritious."

The above quotation from M. Sacc's paper I have taken from the *Revue Agricole*, published at Port Louis, Maurice, vol. 2, no. 6, pp. 81 and 82.

The name cassava should be applied properly only to the purified starch derived from the roots of the plant. The plant is known under the botanical names, *Janipha Manihot*, *Manihot utilissima*, *Jatropha Manihot*, *Manihot Aïpi* and *Jatropha Læfflingii*; it is also called the mandioc plant. The fleshy root of this plant yields the greatest portion of the daily food of the natives of tropical America, and its starch is known in this country under the name of tapioca. *Manihot* is a woody or shrubby plant, growing from fleshy tuberous roots, the stems being smooth, the leaves being generally long-stalked. The leaves of the poisonous variety usually have seven branches palmately divided; the leaves of the sweet variety are usually only five-parted. In the "Treasury of Botany," p. 718, the following remarks are made concerning these two varieties :

"It is quite clear that while the root of one is bitter and a virulent poison, that of the other is sweet and wholesome, and is commonly eaten cooked as a vegetable. Both of them, especially the bitter, are most extensively cultivated over the greater part of tropical America, and yield an abundance of wholesome and nutritious food; the poison of the bitter being got rid of during the process of preparation it undergoes. The poisonous expressed juice, if allowed to settle deposits a large quantity

of starch known as Brazilian arrowroot or tapioca meal, from which the tapioca of the shops is prepared by simply torrefying the moist starch upon hot plates, the heat causing the starch grains to swell and burst and become agglutinated together. A sauce called *cassareep*, used for flavoring soups and other dishes, particularly the West Indian dish known as pepper-pot, is also prepared from this juice by concentrating and rendering it harmless by boiling. Another of the products of cassava is an intoxicating beverage called *piwarrie*, but the manner of preparing it is not calculated to render it tempting to Europeans. It is made by the women, who chew cassava cakes and throw the masticated material into a wooden bowl, where it is allowed to ferment for some days and then boiled. It is said to have an agreeable taste."

From the above analysis of cassava root, descriptions of its uses and the amount of it that can be produced per acre, it is evident that it is destined to become a valuable agricultural product of the sub-tropical portions of our country.

Washington, D. C.

Histology of the leaf of *Taxodium*. I.

STANLEY COULTER.

(WITH PLATE XI.)

Following Endlicher, in his *Synopsis Coniferarum*, 1847, *Taxodium distichum* is placed in the sub-order Cupressineæ. Sachs suggests, however, that this arrangement of the Coniferae can only be considered tentative, until further light is thrown upon the nature of female flowers of various genera.¹ As it is not the purpose of this paper to present any fact regarding this point, a general description of the appearance of the tree is alone given.

Under favorable circumstances, *Taxodium distichum*, the Ahuahete of the Mexicans, "reaches a height of 150 feet, with a trunk diameter of from 10 to 12 feet or more."² According to Humboldt, attaining a height of 120 feet, it has a diameter of from 32 to 40 feet.³ It bears linear, acute, 2-ranked, crowded and deciduous leaves, from 5 to 8 mm. long, upon slender leafy branchlets, a part of which are also deciduous in autumn. Its range in the United States is from southern Delaware to southern Florida near the coast, and from Carroll county, Indiana, southern Illinois and Missouri, southward to Alabama, Louisiana and eastern Texas.⁴

¹ Sach's Text Book of Botany, 1st English Ed., p. 459.

² Sargent's Catalogue of the Forest Trees of N. A., p. 65.

³ Aspects of Nature II, p. 94.

⁴ Sargent's Catalogue Forest Trees of N. A. l. c.